Docket No.: 052363-0029 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 20277
Yukihiro OISHI, et al.	:	Confirmation Number: 9363
Application No.: 10/561,536	:	Group Art Unit: 1793
Filed: December 19, 2005	:	Examiner: Velasquez, Vanessa T

For: MAGNESIUM-BASE ALLOY SCREW AND METHOD OF MANUFACTURING THE SAME

RESPONSE TO NOTICE OF NON-COMPLIANT APPEAL BRIEF (37 CFR 41.37)

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Notice of Non-compliance issued March 16, 2009 regarding the Appeal Brief filed February 17, 2009 in support of the Notice of Appeal filed on December 16, 2008. The Notice of Non-compliance has a one-month shortened statutory period for response set to expire April 16, 2009.

A Corrected Appeal Brief is being filed to correct the errors in the previously filed Appeal Brief. The Appeal Brief fee of $540.00 was previously paid on February 17, 2009.

REMARKS

The Notice of Non-Compliant Appeal Brief (37 CFR 41.37) stated that the Brief 1) does not contain a concise explanation of each independent claim (claim 1) which refers to the specification by page and line number; 2) does not contain a concise statement for each ground of rejection on appeal and 3) that the Argument section must match the grounds section insomuch as each grounds corresponds to a heading within the Argument section. Applicants respectfully submit a corrected Brief in which the following sections below were replaced: the "Summary of Claimed Subject Matter", "Grounds of Rejection" and "Arguments".

Respectfully submitted,

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Docket No.: 052363-0029 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	:	Customer Number: 20277
Yukihiro OISHI, et al.	:	Confirmation Number: 9363
Application No.: 10/561,536	:	Tech Center Art Unit: 1793
Filed: December 19, 2005	:	Examiner: Velasquez, Vanessa T

For: MAGNESIUM-BASE ALLOY SCREW AND METHOD OF MANUFACTURING THE SAME

CORRECTED APPEAL BRIEF

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed December 16, 2008, wherein Appellants appeal from the Primary Examiner's rejection of claims 1-5, 22 and 23.

Real Party In Interest

This application is assigned to Sumitomo Electric Industries, Ltd. by assignment recorded on November 12, 2008, at Reel 021842, Frame 0832.

Related Appeals and Interferences

To the best of Applicants' and Applicants representatives' knowledge, there are no related appeals or interferences (see Related Proceedings Appendix).

Status of Claims

1. Claims canceled: 21
2. Claims withdrawn from consideration, but not canceled: 6-20
3. Claims pending: 1-5, 22 and 23
4. Claims allowed: None
5. Claims rejected: 1-5, 22 and 23
6. Claims on appeal: 1-5, 22 and 23

Status of Amendments

After the Final Rejection issued on June 16, 2008, the limitations of claim 21 were incorporated into independent claim 1 in the Response filed on September 16, 2008. This amendment was entered as indicated in the Advisory Action mailed on October 27, 2008.

Summary of Claimed Subject Matter

One embodiment of the present invention as recited in independent claim 1 is directed to a magnesium-based alloy screw (Spec. paragraph [0012], p. 5, line 8)

having a head portion (Spec. paragraph [0011], p. 4, line 20)

and a thread portion, (Spec. paragraph [0011], p. 4, line 23)

wherein the screw is formed from a drawn wire made of a magnesium-based alloy, (Spec. paragraph [0011], p. 4, lines 20-21)

and the wire has an average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less; (Spec. paragraph [0013], p. 5, lines 17-19)

wherein the tensile strength of the screw is 220 MPa or higher. (Spec. paragraph [0068], p. 36, lines 4-5)

Grounds of Rejection To Be Reviewed By Appeal

(1) Claims 1-5, and 22-23 stand rejected as being unpatentable over Thum & Lorenz (Centre of Darmstadt College of Higher Education, pp. 667-673, Vol. 84, No. 26, English Translation) in view of Housh et al. (Selection and Application of Magnesium and Magnesium Alloys," Vol. 2, ASM Handbooks Online) and Hawley's Condensed Chemical Dictionary (14th Ed., revised by Richard Lewis, Sr.)

(2) Claim 21 stands rejected as being unpatentable over Thum & Lorenz (Centre of Darmstadt College of Higher Education, pp. 667-673, Vol. 84, No. 26, English Translation) in view of Housh et al. (Selection and Application of Magnesium and Magnesium Alloys," Vol. 2, ASM Handbooks Online) and Hawley's Condensed Chemical Dictionary (14th Ed., revised by Richard Lewis, Sr.), and further in view of Higgins (Engineering Metallurgy, Part I: Applied

Physical Metallurgy, 6th Ed., pp.90-94) and Callister, Jr. (Materials Science & Engineering, An Introduction, 6th Ed.), with evidence from Webster's New World Dictionary (3rd College ed., Victoria Neufeldt, Editor).

Argument

1) Claims 1-5, 22 and 23 are not obvious over Thum & Lorenz, Housh, and Hawley's Condensed Chemical Dictionary.

Applicants respectfully submit that Thum & Lorenz, Housh, and Hawley's Condensed Chemical Dictionary, in addition to Higgins and Callister, Jr. fail to render claims 1-5 and 22-23 obvious for at least the following reasons.

As the limitations of claim 21 were incorporated into independent claim 1, Applicants will referring to the rejections of claim 21 of the June 26, 2008 Office Action in addressing the patentability of claims 1-5 and 22-23 below.

One embodiment of the present disclosure teaches a wire that is formed into a screw by drawing a magnesium-based alloy has an average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less, wherein the tensile strength of the screw is 220 MPa or higher. As a result of this feature, a screw having excellent tensile characteristics can be formed, even at temperatures lower than the usual temperature at which magnesium-alloys are worked.

It is admitted in the Office Action that Thum & Lorenz, Housh and Hawley's Condensed Chemical Dictionary all fail to disclose a screw formed from a drawn wire made of a made from a magnesium based alloy which has an average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less. However, it is alleged that Higgins teaches that grain diameter is a result of the degree of deformation imparted to any alloy. As such, it is alleged that achieving the claimed grain size would require only routine optimization of the drawing process by one of ordinary skill and accordingly, would have been obvious to produce an alloy with the claimed grain size. Furthermore, it is also alleged that grain size is a result-

effective variable, as taught by Callister, Jr. in which the Hall-Petch relationship shows that the smaller the grain, the stronger the material.

Applicants respectfully disagree with these allegations. Specifically, Hawleys, Webster's New World Dictionary and Higgins all teach techniques relevant to general metalworking or general metallurgical engineering, not for work with magnesium or magnesium alloys.

Thus, techniques disclosed in Hawleys, Webster's New World Dictionary and Higgins are not applicable to Thum & Lorenz and Housh, which are admittedly silent with regard to grain crystal size.

Thum & Lorenz discloses magnesium-based threaded fasteners with bolts and nuts having different compositions (see, page 3-4, threaded fasteners #s 1-6 in Thum & Lorenz). Table 1 shows magnesium-based alloys having tensile strengths ranging from 235 MPa to 343 MPa, of which Magnewin 3512 contains 3% Al, 1% Zn, and 0.2-0.5% Mn. However, Thum & Lorenz does not disclose that the threaded fasteners are formed from a drawn wire of a magnesium-based alloy and it is completely silent as to average and maximum crystal grain diameters of the magnesium-based alloy.

Housh teaches that magnesium-based alloy is desirably drawn at elevated temperature because it reduces the time involved for making magnesium parts and enhances dimensional tolerance (see, http://products.asminternational.org/hbk/index/jsp(1 of 8)/6/9/2008, "Formability", 2nd paragraph). In addition, Housh teaches that magnesium alloy ZE63A-T6 which contains 5.8% Zn, 0.% Zr and the remainder Mg has a tensile strength of 300 MPa. This alloy is a material for sand and permanent mold castings. However, Housh fails to disclose crystal grain diameters of the magnesium-based alloy.

Furthermore, although Callister, Jr. shows that reduction in grain size provides for stronger material, it is also well known that plastic workability of magnesium and its alloy is extremely poor at low temperature (i.e., room temperature) due to the hexagonal close-packed lattice structure, as described in paragraph [0003] of the present application. For this reason, magnesium-based alloys are conventionally worked at temperatures in which the plastic workability increases (i.e., 250 °C or higher, see, Housh p. 1, 2nd paragraph and paragraph [0006] of the present specification). However, when working at this temperature, the grain structure becomes coarse. As such, one skilled in the art would not achieve a uniform and fine structure of a drawn material with the claimed crystal grain diameter by using conventional techniques as described in the prior art.

It is alleged in the Advisory Action that the teachings of Callister are relevant to magnesium alloys because the motivation to produce a fine-grained material is derived from the desire to impart grater strength to the alloy. Further, it is reasoned that it is desirable for screws to have high tensile strengths, for they are subjected to high tensile forces. As such, it is alleged that it would clearly be within the scope of one of ordinary skill in the art to utilize the teachings of Hawley's, Websters, Higgins and Callister in conjunction with the primary references by applying them to a specific metal or metal alloy of choice, such as magnesium or magnesium alloys, to obtain a metal with desired characteristics.

Applicants respectfully disagree. The above argument is a vague statement of general properties of metals. However, Applicants submit that it would not be obvious that these generalized teachings would be specifically applicable to magnesium and magnesium alloys. It is alleged that while Thum & Lorenz do not teach that the magnesium fasteners are made from a drawn wire, it is obvious to form the bolts of Thum & Lorenz from the drawn wire of Housh and

Hawley's. Moreover, although it is admitted that Thum & Lorenz, Housh, and Hawley's are silent with regard to the grain diameters of the magnesium alloy, Higgins teaches that a grain diameter is a result of the degree of deformation imparted to the alloy. Thus, it is alleged that it is obvious to operate a drawing process so as to achieve a particular grain size. Furthermore, since Callister teaches that smaller gains impart greater strength to a material, it is suggested that it would be obvious to suppress the grain diameter to less than 15 microns, as is recited in claim 1 of the present disclosure.

However, these allegations are without merit. None of the cited references disclose specifically decreasing an average crystal grain diameter to 10 μm or less, or a maximum crystal grain diameter to 15 μm or less. Rather, it is only generally suggested that "smaller" grain size leads to higher strength.

However, as stated above, in conventional techniques the plastic workability of magnesium and its alloy is extremely poor at low temperature due to the hexagonal close packed lattice structure (see, paragraph [0003] of the present disclosure). For this reason, a skilled artisan believes that magnesium-based alloy materials must be worked at a temperature at which plastic workability would increase (such as greater than 250 °C). For example, when a conventional cold drawing was applied in producing a magnesium-based alloy wire, industrial production was extremely difficult because of breakages of the wire during working. However, if the wire was processed at a temperature of 250 °C or higher, growth of grain would be accelerated and the grain structure would become coarse. Thus, it would not be possible to obtain a uniform, fine structure in a drawn material with an average crystal grain diameter of 10 μm or less and a maximum crystal grain diameter of 15 μm or less.

In contrast, the wire of the present disclosure made from magnesium-based alloy which forms a magnesium-based alloy screw is obtained by a specific drawing and thereby has the average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less. The specific drawing is disclosed in paragraphs [0014] and [0039] of the specification. In this drawing, a temperature rising speed to working temperature is 1 °C/sec to 100 °C/sec, working temperature is 50 °C or higher and 200 °C or lower, working ratio is 10% or more per one drawing (one pass), and after extruded material is drawn, the obtained wire is heated to 100 °C or higher and 400 °C or lower. By fining down the alloy structure of a wire made of a magnesium-based alloy, plastic workability can be enhanced even at a temperature of less than 250 °C. Unlike conventional techniques, it is unnecessary to heat the wire to a temperature higher than 250 °C at screw working, and therefore, it is possible to increase the lifetime of working tools for creating the screws.

As such, as it has not been shown in the Office Action that any of the cited prior art discloses a drawn magnesium wire having the claimed range of crystal grain diameter, and as the above arguments show that it would not be obvious to one skilled in the art that such a crystal grain diameter is obtainable through the techniques described in the cited prior art, Applicants submit that the cited prior art fails to render claim 1 obvious.

In order to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. As is clearly shown, Thum & Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr. do not disclose a magnesium-based alloy screw having a head portion and a thread portion, wherein the screw is formed from a drawn wire made of a magnesium-based alloy, and the wire has an average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less; wherein

the tensile strength of the screw is 220 MPa or higher. As such, Thum & Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr., alone or in combination, fail to render claim 1 obvious and accordingly, claim 1 is patentable. Accordingly, Applicants respectfully request that the § 103(a) rejection of claim 1 be withdrawn.

Moreover, as claims 2-5 and 22-23 are dependent upon claim 1, and claim 1 is allowable for the reasons set forth above, Applicants submit that claims 2-5 and 22-23 are allowable over the cited prior art as well.

2) Claim 21 is not obvious over Thum & Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr.

As the limitations of claim 21 were incorporated into independent claim 1, the rejection of claim 21 over Thum & Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr. is now moot, and these rejections are addressed above in the arguments concerning claims 1-5 and 22-23.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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CLAIMS APPENDIX

1. A magnesium-based alloy screw having a head portion and a thread portion,

wherein the screw is formed from a drawn wire made of a magnesium-based alloy, and the wire has an average crystal grain diameter of 10 μm or less, and a maximum crystal grain diameter of 15 μm or less; wherein

the tensile strength of the screw is 220 MPa or higher.

2. The magnesium-based alloy screw according to claim 1, wherein the magnesium-based alloy contains Al: 0.1 to 12% by mass.

3. The magnesium-based alloy screw according to claim 2, wherein the magnesium-based alloy contains one or more of Mn: 0.1 to 2.0% by mass, Zn: 0.1 to 5.0% by mass and Si: 0.1 to 5.0% by mass.

4. The magnesium-based alloy screw according to claim 1, wherein the magnesium-based alloy contains Zn: 0.1 to 10% by mass and Zr: 0.1 to 2.0% by mass.

5. The magnesium-based alloy screw according to claim 1, wherein the magnesium-based alloy contains rare-earth element: 5.0% by mass or less.

22. The magnesium-based alloy screw according to claim 1, wherein the head portion of the screw is formed by head working to the drawn wire heated in the range of 140 °C or higher and lower than 250 °C.

23. The magnesium-based alloy screw according to claim 1, wherein the thread portion of the screw is formed by thread working to the drawn wire having the head portion heated in the range of 100 °C or higher and lower than 250 °C.

EVIDENCE APPENDIX

No evidence provided during prosecution, but available upon request.

RELATED PROCEEDINGS APPENDIX

To the best of Applicants' and Applicants representatives' knowledge, there are no related appeals or interferences.